# THE DIRECT TEACHING OF THINKING SKILLS FOR IMPROVEMENT OF READING TEST RESULTS

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# The Direct Teaching Of Thinking Skills For Improvement Of Reading Test Results

An abstract of a Thesis by
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The problem. The purpose of this study was to address the direct teaching of critical thinking and problem solving skills, and to determine if the process benefited fourth grade students by increasing scores on a reading end-of-book test.

Procedures. Two similar, but not randomly selected fourth grade classes, were chosen to take part in this study. Both groups were given identical criterion referenced end-of-book reading pretests. The experimental group was then treated with the CoRT program (Cognitive Research Trust). The CoRT program emphasized the direct teaching of critical thinking skills. The control group received regular reading instruction during this period. After 12 weeks of instruction in the CoRT Program, both groups were given the post test to determine the gain which had occurred. An ANCOVA was run on the data to make statistical adjustments on the dependent variable or testing device. Comparisons were made on the adjusted means.

Findings. A comparison of adjusted means indicated that there were no statistically significance differences between the experimental group and the control group at the .05 level. The null hypothesis was not rejected as a result of the findings. A delta test was calculated to determine if there were practical significance to the findings. The delta test indicated that a practical significance did exist.

Conclusion. No statistically significanct differences were found to exist between the experimental and control groups. Consensus by leading researchers support the findings of the statistical and practical significance although only practical significance was supported by this study.

Recommendations. Testing and accurately measuring the gain in critical thinking and problem solving

skills is extremely hard to accomplish. The writer suggests more research is needed to determine the extent to which critical thinking skills can be taught. Past research, coupled with encouraging results in this study, indicated that the implementation of CoRT critical thinking skills into the curriculum may produce favorable results.

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# Chapter I

# INTRODUCTION

## Rationale

Teachers and administrators have long been frustrated by students' inability to think critically and solve problems. For many generations academic disciplines and teacher-centered pedagogy have been relied upon to transmit to students the thinking skills they need (Edwards, 1985). Increasingly, it has become clear that this faith has been misplaced.

Studies such as that of Gunstone and White (1980) have shown that even the best products of our secondary schools have impoverished thinking skills. Similarly, studies such as that of Edwards and Marland (1984) have concluded that what is going on inside the heads of children in classrooms is far removed from what one would want. Professional journals, education reports, researchers, and state departments of education now are focusing on this problem in education. One cause of this problem is that students were accustomed to teachers telling them what to do, when to do it, and how to behave when they do it.

Thinking skills are not a new topic in education. The major advocate of inquiry/problem solving was John Dewey. The steps of inquiry (Dewey, 1933), often called the scientific method, are familiar to educators. His essential functions help in the analysis of the process and planning of procedures and techniques to use in preparing classroom experiences (Fair & Kachaturoff, 1988). The inquiry method is a process of investigation which moves through these steps: (a) recognizing the problem, (b) analyzing the problem, (c) formulating an hypothesis, (d) selecting and defining problems, (e) collecting data, and (f) drawing conclusinons based upon data.

Ideas from Dewey's work assisted in the development and identification of levels of thinking skills as described in Bloom's taxonomy (1956). These ideas were identified as follows: (b) knowledge from information and facts, (b) comprehension or translating and interpreting, (c) application of ideas to specific situations, (d) analysis which includes recognizing assumptions, hypothesis, and supporting facts, (e) synthesis or making a structure not there before or being able to analyze a set of abstract relations,

(f) evaluation or judging in terms of internal standards which may or may not be value-laden.

In an effort to make instruction in thinking more manageable for teachers, Taba grouped thinking abilties much as Bloom did in his taxonomy (Fair & Shaftel, 1967). Taba described thinking skills in the following way: (a) conceptualizing or forming ideas and concepts, (b) interpreting or making more meaning out of a set of data than is literallly there, (c) applying or using ideas in new and specific situations, (d) evaluating or judging by standards, which may or may not be value-laden. Since Dewey's time, each decade has addressed curricular reform in the area of critical thinking. There is a growing interest in teaching thinking and several programs have been designed specifically for that purpose. These programs differ in many ways: in their theoretical rationale, in their methods, in the type of students for whom they teach, and in the evidence of their effectiveness. Most do not fall into neat categories and defining them is a complicated process. Many of the programs do achieve favorable results which can not be ignored (Chance, 1986).

Some teachers will resist any new additions to an already crowded curriculum. However, there are several compelling reasons for the inclusion of thinking skills. The work place of the future will be one of fast-paced changes for today's students. They will have to be prepared to change jobs several times throughout their working career. There is a movement in business toward shared decision making and site-based management. All workers will have to be prepared for and face these challenges. Assessments of student achievement suggest that today's student population may be failing to develop effective thinking and problem solving skills (Bransford & Sherwood, 1986).

There is also a need for students of all ages to be able to make sound decisions. Television tells the American public what to purchase, how to act, what the news means, and more. Children must have the ability to sort the trash from what is important and useful, and to distinguish between what is entertainment and fact. Crucial decisions about the use of drugs, alcohol, and sex are theirs to decide.

In schools, achievement of basic literacy is not enough. Advocates of teaching thinking skills say that

our goal in education should be to produce students who are literate and competent thinkers. New research on how people learn to think indicates that mental processes associated with thinking are not of a "higher order" of mental development. Thinking skills are intimately involved in successful learning even at the early elementary level and should pervade the entire curriculum from kindergarten through grade 12.

Current cognitive research has shown that learning requires knowledge, but knowledge cannot be given directly to students. Students need to elaborate, question, and examine related information in order to build new knowledge structures. The new information must be linked, interpreted, and explained, but not by the teacher--by the student involved (Resnick & Klopfer, 1989).

John Edwards (1985) of James Cook University in Australia has conducted research on what high school students were thinking during class lectures. He videotaped selected students during a teacher's lecture. Immediately after, he conferenced with each as they watched the tape asking them what they were thinking about as the lecture progressed. Few were ever on task. He concluded that student involvement in

a lesson was a must for learning to take place. Involvement has a major role in the thinking curriculum (De Bono, 1986).

## Statement of the Problem

Over the last 20 years there has been a resurgence in interest in the direct teaching of thinking skills. The Harmony Area School District has stated in its philosophy of education, "The basic knowledge obtained by children must be enhanced with the skills of critical thinking, problem solving and decision making."

Currently, there are a large number of programs claiming to teach students improved thinking skills. Few of these programs have been carefully evaluated by independent researchers.

To determine the impact of the direct teaching of thinking skills, the following questions need to be asked:

1. Can direct teaching of thinking skills improve students' test scores in reading over a short period of time?
2. What reading skills will benefit from direct teaching of thinking skills?

## Hypotheses

The investigator used the following research hypotheses for this study:

1. There will be a significant increase in the reading test scores of all students. The

dependent variable or testing device will be a redesigned criterion referenced end-of-book basal reading test.

2. The independent variable or group receiving the level one Cognitive Research Trust (CoRT) instruction will show improvement at a significantly higher level than the control group.

## Significance of the Study

The idea of teaching thinking has become something of a bandwagon, with a rush to teach the most familiar form of it--critical thinking. Critical thinking has a place, but there is a very grave danger in believing that is all there is to thinking (de Bono, 1983).

The CoRT Thinking Lessons were chosen for this study because they are a simple, practical, clear, focused, and serious approach to the teaching of thinking. They easily lend themselves to cooperative group work and a global perspective. The specific purpose of CoRT one lessons is to broaden perception so that any thinking situation will be viewed beyond the obvious, immediate, and egocentric. The direct method was chosen because it is more focused and easier to measure.

## Definition of Terms

CoRT Thinking Lessons is an acronym that stands for Cognitive Research Trust. Based on the premise that it is indeed possible to teach thinking as a skill, it contains 60 lessons divided into six sets of 10 lessons each.

Higher-level thinking skills is a generic term that refers to any of several abilities, including: creative, divergent, or fluent thinking; cognitive complexity; and problem solving. These skills are analytical in nature as opposed to perceptual and are often a source of many errors in thinking (de Bono, 1983).

## Statement of General Methodology

### Instrumentation

The end-of-the-book test from the current basal reading series has been redesigned (see Appendix A) in order to measure the skills closely connected to higher level training ability. Not all reading skills were tested. Both groups were given the pretest and in 12 weeks they were administered the same test again. This

gave a clear picture of the amount of growth which took place during the time period.

Much care was given in preparation for the administration of this criterion-referenced test. The instructors who administered this test became familiar with the test well in advance of the testing date (see Appendix C). The teachers closely monitored the students' test-taking behavior to make sure each child followed and understood directions. The test was not timed.

Sampling

Groups for this study included 60 students in two fourth-grade classrooms who were divided at random prior to the start of the 1989/90 school year. The treated group were taught CoRT Thinking Skills two times per week at 40 minutes per treatment for a total of 960 minutes. The control group received no treatment.

The CoRT one lessons introduce the basic training skills of thinking. The students' perception is broadened by demonstrating a number of different directions that thinking can follow. Each lesson includes an introduction, practice items, process

discussions, principles involved in the skill, and a project to conclude the skill.

# Chapter II

# REVIEW OF THE LITERATURE

## Introduction

The renewed interest in how to teach students to be better thinkers is one of the most important directions that education has taken in recent years. In just a short time, the level of sophistication of educators' efforts to develop, implement, and evaluate programs that teach thinking has risen considerably (Baer, 1988).

Efforts to find a program to effectively teach thinking skills were not for the purpose of advocating a course of study for an exclusive group of gifted andtalented or college-bound students. The program had to enrich the curriculum of all students at all levels and would produce lively, stimulating classrooms.

## Methods of Teaching

Cognitive skills can be taught within the context of the usual school subjects, by training in a specific school subject, or by a combined approach (Herrnstein & Nickerson, 1986).

## Direct Teaching

One method of teaching thinking is by directly teaching classes in "How to Think." A program of this kind is CoRT (Cognitive Research Trust). Edward de Bono developed this program into a series of lessons that build and alter thinking processes. The lessons focus on the perceptual aspect of thinking and may be used on students at any level. However, de Bono believed that thinking is best taught to youngsters in the middle grades, where motivation is very high.

Four levels of achievement were expected: (a) awareness of thinking as a skill, (b) a structured approach to thinking as choice and alternatives, (c) the organization of thinking as a series of steps, and (d) the consciousness of the metacognitive level of thinking. In other words, students were thinking about thinking.

John Edwards' (1985) research indicates that direct teaching of thinking has a positive effect on test scores of many types. In one study, a tenth grade science class was divided in half. The control group was taught the regular science curriculum. The other group was taught one half of the science curriculum and the remainder of the class time was spent teaching CoRT

skills. On the end-of-the-year science test, students who had received the CoRT training scored better on the test than those who had received more science instruction (de Bono, 1983). Other studies of Edwards' showed statistically significant gains in the Otis-Lennon School Ability Test, Waetjen's Self Concept as a Learner Scale, and the Torrance Test of Creative Thinking as a result of direct teaching.

## Integration

Integration into the regular curriculum is the other method of teaching thinking skills. Thinking skills may be incorporated into any subject matter at any level. Integration could range from a few changes in teaching style to revitalizing the entire curriculum.

Teachers should use specific cognitive terminology and show students how to perform particular skills. For example, instead of saying, "What did you think of this story?" say "What conclusions can you draw about this story?" Students will internalize the words and use them as a part of their own vocabulary.

When giving directions, teachers should not "spoonfeed" students by providing too much information. Students should be required to analyze a task, identify

what is needed to complete the task, and then perform the task. For example, instead of saying, "For tomorrow's field trip, remember to bring spending money, comfortable shoes, and a warm jacket," ask "What must we remember to bring with us on our field trip?"

To encourage careful thinking, teachers should avoid vagueness and generalizations. They should encourage students to define terms, be specific about actions, use accurate descriptors, and make precise comparisons. When a teacher hears "Things go better with . . ." say "Which things specifically?"

Teachers should ask students to describe the thought processes that they are using, the data they used, and the plans they formulated. Students eventually learn to think about thinking (Costa & Marzano, 1987). When children say "I don't know how to solve this problem," say "What can you do to get started?"

Building learner outcomes that reflect the use of Bloom's taxonomy classifications is perhaps a more thorough method of assuring that thinking and learner involvement will be integrated throughout the curriculum. Knowledge, comprehension, application,

analysis, synthesis, and evaluation can be the basis for designing a thinking curriculum.

## Critical Thinking and Cooperative Learning

The most recent report issued by the U.S. National Assessment of Educational Progress discussed the increased concern about the critical reading abilities of our nation's students (National Assessment of Educational Progress [NAEP], 1988). One of the major problems noted is that students are not given enough opportunity to engage in instructional activities which foster their higher level thinking skills.

Reading skills are often taught in isolation. One way to address this is by applying thinking skills to problems. Problem solving is a thinking process. Applying thinking skills to problems in text makes it virtually impossible to segregate reading skills into individual compartments.

Since critical reading ability is a major goal in reading instruction, why does this problem exist? Maybe the answer could lie in providing classroom teachers with effective teaching strategies (Flynn, 1989).

Problem solving strategies present the classroom teacher with a framework which gives form and structure

to the confusing array of critical reading skills. Problem solving strategies give the student useful tools for acquiring new information in novel situations.

Many approaches to problem solving are available, but one called the IDEAL (Bransford & Stein, 1986) approach works very well with cooperative learning techniques. The IDEAL approach to problem solving can be used in the following way:

Identifying. Unless a student realizes that a problem exists, he or she can hardly be expected to search for a solution.

Defining. Defining the problem more clearly is an important stage because it determines the strategies that will be used in exploration. Representing the problem in another form is helpful during this stage.

Exploration. Breaking down the problem during the exploration stage is recommended (Bransford & Stein, 1986). Other strategies like using special cases and working backward have also been successful. Examining events by these three strategies allow students to formulate hypotheses which can be tested in the next two steps.

Acting and looking. Acting on ideas and looking for the effects are closely related evaluative components of the problem solving process. These two stages combine to test out ideas. If chosen strategies produce inappropriate effects then ideas need to be reevaluated.

Cooperative learning also contributes to the development of critical thinking skills (Flynn, 1989). By combining the essential elements of cooperative learning techniques with the IDEAL approach to problem solving, the classroom teacher can offer students a chance to develop their critical reading abilities in alearning environment that promotes inquiry, self-confidence, and genuine cooperation (Meyers, 1986).

Cooperative learning fosters the development of critical thinking through discussion, negotiation, clarification of ideas, and evaluation of others' ideas. Students working together toward a common goal can accomplish more than students working by themselves (Slavin, 1987). While the group may earn a reward if it achieved a goal, individual accountability means that the success of the group depends on the contribution of each member. Equal opportunity for

success is intended to ensure that the cooperation of each member is valued by requiring that each perform above her/his own pastperformance (Flynn, 1989).

## General Summary

Cognitive research has shown gains in student's motivation to succeed in school when the goal is to produce literate students and competent thinkers. If students think intelligence is something fixed, they will either hide their lack of intelligence or demonstrate it to others. If students think of intelligence as incremental, developed over time, they are motivated to accept or find challenges as ways of developing their intelligence (Resnick & Klopfer, 1989).

Schools with a vision for the future success of their students will need to seriously consider the thinking curriculum. Administrators, teachers, and parents can certainly sense the need for these skills, and current cognitive research supports this need. Research also shows the successful results of the teaching of thinking skills.

According to Resnick and Klopfer, good thinkers and problem solvers differ from poor ones, not in skill level, but in how they use those skills. A generous

block of time in the curriculum must be allotted for the development of good thinking skills (Fair & Kachaturoff, 1988). Emphasis must continue from early grades through high school in all classes. With much effort, understanding, and patience on the part of committed school administrators and teachers, schools will strive to help all students become better thinkers.

# Chapter III

# METHODOLOGY

## Introduction and Purpose

The purpose of this study was to determine the impact of the direct teaching of thinking skills. In this case, short term (12 weeks) direct teaching was utilized to see if test results on the whole could be improved and if so, which specific skills would be most positively affected.

The first component of the study was to choose which method of direct teaching was to be utilized. The CoRT program was selected because it it was available in the school district and an instructor had been inserviced in the methods and skills needed to effectively teach the program.

The second component of the study was to determine the time frame during which the direct teaching skills would be taught. Because of other curricular considerations and the number of weeks remaining in the school year, it was determined that 12 weeks would serve as a fair time commitment to serve as the short-term period of instruction.

## Construction of the Test

The redesigned criterion referenced test (Appendix A) was devised to place emphasis on the skills of decoding and phonics, comprehension and vocabulary, literature and language, and study skills. Thinking skills, in the area of decoding and phonics, focused on using the meanings of prefixes and suffixes and using base words to establish word meanings. Comprehension and vocabulary skills are areas where the elements of critical thinking can enhance success for students. Skills utilizing a student's ability to arrange written material in a sequential format, to predict outcomes, and to understand cause/effect relationships may be positively magnified by sound thinking strategies. Literature and language data focused on using the presented material to form inferences. Study skills involved following multi-step directions, reading diagrams, and interpreting graphic aids.

The objectives measured in this test have been taught several times and tested throughout the year. Thus, the students will have had repeated exposure to the objectives through activities and frequent practice opportunities.

The end-of-the-year tests are designed to provide skill area scores, as one indication of the student's reading performance, and a total test score for all skill areas, as a more general indication of the student's reading performance. A description of the test is included in Appendix B.

A critical requirement in criterion referenced testing is that students understand exactly what they are expected to do. In order to administer the test efficiently and make directions understandable, the teacher should become familiar with the directions and the test items before the test is given (see Appendix C). In addition teachers were requested to closely monitor the student's test-taking behavior to make sure that each child was following the directions, was on the correct item, and was marking the test correctly.

Precautions were taken to ensure the test taking setting was comfortable for all students. Distractions such as noise or activities were at a minimum. The test was not timed and was administered in two separate sittings.

## Selection of Groups

At the start of the 1989/90 school year there were 60 students entering the fourth grade. When the students were split into two separate sections, much thought and time was given to assure parents, teachers, and the school board that two balanced groups of students would exist. Ability, behavior, attitude, special problems, groups of friends, and the sex of the individuals were taken into consideration for equalizing the sections. The current teachers, who knew the students best, made the initial placement and then the next year's teachers and the administration reviewed the class placement to correct any possible oversights. Requests from parents were not considered under normal conditions; however, parents may present information which is beneficial in making the final class placements. When all possible combinations and characteristics were finalized, hopefully, there were two very comparable class groups arranged for the next school year.

## Collection of Data

In February, 1990, a criterion referenced test was designed to test students on their reading skills. This test (Appendix A) was administered to both groups

of students with specific directions on how to administer the test provided to the instructor (Appendix C). In early May, 1990, the test was retaken by both groups under nearly identical conditions. Students were identified by number and not by name. The two students who did not take both the pretest and posttest were eliminated from the sample.

Collection techniques and scoring of the test were exactly the same for both groups and for the pre- and posttests. Test results were scored and recorded by the same person in each case. The group receiving the CoRT treatment included 30 students while the control group included 28.

## Treatment of Data

After the data had been collected and coded, it was entered into the computer for statistical analysis. An analysis of covariance was selected as the data analysis procedure because of the statistical power offered and differences between groups on the pretest. In addition, the author was interested in adjusted posttest means from which an examination of the practical significance of the findings could be conducted.

Hypotheses 1 and 2

Hypothesis 1 stated there would be a significant increase in the reading test scores of all students. Hypothesis 2 stated there would be no significantly significant higher reading test scores for the group receiving level one CoRT instruction than that of the control group.

# Chapter IV

# FINDINGS

## Introduction

The basic problem for this study was to determine if the direct teaching of critical thinking skills, over a short period of time, could improve reading test results for fourth grade students. The pretest and posttest were given 12 weeks apart. The test was divided into 11 sub-categories, but was scored on a total point basis. Composite scores on reading post tests were compared by first looking at the starting points on the pretest, and then comparing gains realized on the posttest.

## Analysis of the Hypothesis

The first null hypothesis for this study stated that there would be no difference between the means of the pretest and posttest scores in reading for a increase in the mean reading test scores for students participating in the study. The table of means (Table 1) show a pretest mean for the CoRT treated students of 49.57 and a posttest mean of 53.67. An increase in the mean score of 4.1 was observed between the pre- and posttests.

Table 1

Table of Means, Standard Deviations, and t-tests

| School | Pre | Post | S (pre) | S (post) | f | df | alpha |
|---|---|---|---|---|---|---|---|
| District 1 | 49.57 | 53.63 | 9.6 | 8.33 | 4.263 | 29 | <.05 |
| District 2 | 49.07 | 52.29 | 0.05 | 8.60 | 4.628 | 27 | <.05 |

The table of means (Table 1) for the control group on the pretest was 49.07, while the calculated mean for the posttest was 52.29. A statistically significant increase in the mean score of 3.2 was observed between the pre- and posttests.

The increase in mean scores between pre- and posttests for the treated and control groups was an unlikely chance event; therefore, the null hypothesis was rejected.

The second null hypothesis for this study stated that no difference would exist between the means of reading posttest scores of students who were treated with the CoRT program, and those students receiving traditional instruction. The analysis of covariance (Ferguson & Takane, 1989) was utilized to analyze the compiled reading test data which are shown on Table 2.

The objective in the statistical analysis was to determine whether the differences in reading achievement between the groups were significant at the .05 level. The SPSS report (Table 2) indicated that the significance of F was .370 at the .05 level. This data indicates that there were 370 chances in a 1,000 that these results could have occurred by chance. Therefore, the null hypothesis could not be rejected.

Table 2

Analysis of Variance (one covariate) Sum of Squares Table for Pretest and Posttest Reading Scores

| Source of Variation | Sum of Squares | df | Mean Square | F | Significance of F |
|---|---|---|---|---|---|
| Covariates (Total raw score) | 3063.528 | 1 | 3063.538 | 176.528 | .000 |
| Main Effects (District) | 14.1744 | 1 | 14.174 | .817 | .370 |
| Explained | 3077.701 | 1 | 1538.85 | 88.690 | .000 |
| Residual | 954.299 | 55 | 17.351 | | |
| Total | 4032.000 | 57 | 70.737 | | |

The analysis of covariance was able to make adjustments on posttest reading score for the

differences of entry levels of each student based on pretest results. The ANCOVA provided adjusted means for both the control and experimental groups. The adjusted mean for the experimental groups was 54.15 and the adjusted mean for the control group was 51.78 (see Table 3). A delta test (Ferguson & Takane, 1989) was calculated to determine if there was practical significance based on the adjusted means. Results of the delta test indicated that approximately 72% of the students in the experimental group scored higher than the mean of the students in the control group. Further interpretation of the delta test results indicated that 21 out of 30 fourth grades students in the experimental group scored above the mean of the control group.

Table 3

Calculations for Delta Using Adjusted Means

Delta equals the mean of the experimental group minus the mean of the control group divided by the square root of the mean square of the residual (error).

$$\Delta = \frac{\bar{X}e - \bar{X}c}{\text{MS error}} = \frac{54.15 - 51.78}{17.351}$$

$$= \frac{2.37}{4.165}$$

DELTA = .569

Calculating the possible benefits for the 420 students in the school district, the delta test suggests that 92 additional students could be expected to improve their reading test results beyond the current mean reading level. The adjusted mean score for the CoRT treated group of 54.15, compared to the adjusted mean score for the control group of 51.78 indicates an improvement of 2.37 test questions responded to correctly. This comparison suggests that the expected reading test results for CoRT treated students would increase by approximately 3.5%.

# Chapter V

# SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

## Summary

The CoRT critical thinking and problem solving program has been developed to help fulfill a basic need in the school curriculum. Designed to be initially used at the upper elementary level, it utilizes the concept that knowledge cannot be given directly to students. Students need to elaborate, question, and examine related information in order to build new knowledge structures. Realization that thinking is a skill, and requires a logical thought process, should be basic to the core curriculum.

Past studies have shown that the CoRT program has produced statistically and practically significant results in many curriculum realms. Although the subject of critical thinking and problem solving is not a new area of concern, measurable progress has been extremely hard to define and evaluate over a long period of time. This study has attempted to focus on the practical aspect of the direct teaching of critical thinking and problem solving skills. It has provided a

short term look at the problems involved in teaching thinking skills, to be weighed against the possible benefits which may be gained by the students. Short-term benefits were realized in a practical but not a statistically significant manner. Just as it takes years of training and practice to become a skillful gymnast or pianist, the development of thinking skills may require the same sort of prolonged and intense study. We ought not to teach thinking in fourth grade, and then forget about it. Although some programs are intended to take a year or less to administer, it probably is safe to say that program developers believe that thinking instruction should not end with the last lesson in a program.

The research indicated several things to the investigator and the administrator of the CoRT program. Students enjoy the program and enthusiastically participate in the daily lessons. More testing should be conducted to see if the transfer of thinking skills is likely to influence test scores in other areas of the curriculum. The time taken away from reading instruction did not have a adverse affect on reading test results.

## Conclusions and Discussion

1. Gains in reading pre-test to post test results were evidenced by both the treated group and by the control group (Table 1).

This conclusion was likely because of the scope and sequence designed into most reading basal programs. Instruction in specific skill areas and continued repetition of these skills assure, in most cases, that some improvement in test scores will occur during the pretest/posttest time span.

2. At the end of twelve weeks of intense direct instruction of critical thinking and problem solving skills, no statistically significance results were found.

For this particular study, there were more than 370 chances in 1,000 that the results could be attributed to chance. The null hypothesis was not rejected.

3. The practical significance of this study suggests that some benefit was realized by the students who received CoRT instruction.

The gain in mean scores, particularly the adjusted mean scores, indicated that improvement had occurred. Speculation on what caused the improvement in scores

may be argued, and the possibility of chance differences must be considered. Based upon previous research, the investigator would also argue the possibility that the CoRT program may have contributed to the improvement in the treated group reading scores.

Some researchers view thinking as a natural ability that develops without instruction. Those that set out to teach thinking assume that it is a least partly a learned skill. If comparisons are made to other skills such as athletics and music, instruction and practice are intricate parts of the developmental process. In the same way, if we view thinking as a set of skills, we may find ways of teaching those skills so that almost anyone can become a competent thinker. Of course, inherent talent is also a necessary ingredient in becoming a more successful thinker. Taba (Fair & Shaftel, 1967) believes that one scarcely needs to emphasize the importance of critical thinking as a desirable ingredient in human beings in a democratic society. People need to think. De Bono (1983), when measuring the effects of a thinking skills program states: "Hard data are judged to be irrelevant or the result of teaching the test. Soft data in the form of teachers' comments are judged to be biased or

subjective" (p. 707). In this study, an attempt was made to determine the worthiness of teaching critical thinking as an independent and crucial part of the elementary curriculum.

## Recommendations

As a result of this study, recommendations for further research projects are still necessary to determine which thinking skills program should be included in school curriculums. The study did suggest that the CoRT program should be considered as one of the possible alternatives in critical thinking programs. Based upon accepted and notable researchers such as deBono and Bloom, critical thinking skills and higher order thinking skills are an acceptable part of school vocabulary. Nearly all program developers agree on the following ten points (Chance, 1986):

1. Thinking is a skill and can be taught
2. Thinking is best taught by direct and systematic instruction
3. The emphasis of instruction in thinking should be upon the process of thinking, not its product
4. Students must use the thinking skills they are to learn

5. Teachers should reinforce the appropriate use of thinking skills
6. Teachers should make allowances for individual and developmental differences among students
7. Thinking must be taught over a period of years
8. An effort must be made to see that the skills taught in the program carry over to other subjects.
9. Thinking should be taught in a relaxed, nonthreatening atmosphere
10. The teacher is the single most important determinant of the success of a thinking program

With the agreement on these critical points by current researchers, further longitudinal studies are essential in long range curriculum planning. Even though the programs now available are not perfect, it is a mistake to postpone efforts to teach thinking. Because practical significance was found as a result of this study, the time allocated to the direct teaching of critical thinking skills was productive. The treatment group did score higher on the posttest with less direct reading instruction.

It must be remembered that thinking, as important as it is, is not the only thing students must learn in school. Basic instruction in the curriculum must occur and will not be improved if one excess replaces another. Teaching thinking skills is in its beginning stages and researchers are asking which skills are the most important to teach and what skills should be taught at a given grade?

For future studies of the CoRT program, this investigator would suggest that tighter controls in the research design be implemented. Careful monitoring of classrooms could have prevented teachers from unknowingly providing computer assisted critical thinking skills to the control group. Other activities such as mind benders, brain teasers, along with the awareness of increased emphasis on critical thinking and problem solving skills, may have contaminated the test results.

Over a 12-week period, this study concluded that no difference existed in reading test scores between those who received CoRT treatment and those who received tradition instruction. While a lot more research in this area needs to be done, a cautious recommendation would be to continually investigate new

developments in thinking skills and experiment with new techniques from time to time. After all, no thinking program is ever really finished.

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# APPENDIX A

## Reading Test

A. What is the meaning of each key word?

1. perfection

a. state of being perfect
b. in a perfect way
c. able to be perfect
d. one who is perfect

2. plentiful

a. cause to have plenty
b. one who has plenty
c. lack of plenty
d. full of plenty

3. adjustment

a. not adjusted
b. process of adjusting
c. adjust badly
d. able to adjust

4. decidedly

a. in a decided manner
b. decided again
c. process of deciding
d. one who decides

5. unwilling

a. state of being willing
b. not willing
c. one who is willing
d. cause to be willing

6. mislabel

a. label wrongly
b. able to label
c. result of labeling
d. process of labeling

7. nonpermanent

a. condition of being permanent
b. opposite of permanent
c. permanent again
d. in a permanent way

8. incurious

a. full of curiosity
b. state of being curious
c. in a curious way
d. not curious

B. What is the base word of each key word?

1. impolitely

a. politely
b. imp
c. impolite
d. polite

2. misjudgment

a. men
b. judge
c. misjudge
d. judgment

3. unwelcomely

a. coming
b. unwelcome
c. welcome
d. welcomely

4. disgraceful

a. race
b. grace
c. graceful
d. ace

5. reconsideration

a. ration
b. consider
c. side
d. consideration

6. indelicately

a. delicately
b. cat
c. delicate
d. ate

C. Read the story. Then answer the questions.

Kara stopped her bicycle at Clover's Stables. There she watched two men trying to load a horse into their trailer. They were having a hard time because the horse kept kicking and rearing. "He's just scared," Kara thought, the sighed. Her own horse, Buttercup, had disappeared recently. He had looked just like this horse. Just then the horse turned his head toward Kara. She saw the familiar white blaze on his nose. Kara cried out in surprise. She ran toward the men, shouting, "Wait a minute - let me talk to you!" The horse whinnied happily as she came near.

1. What do you think happened next?

a. The horse reared again.
b. Kara asked the men where they had gotten the horse.
c. The men led the horse easily into the trailer.
d. Kara rode the horse.

2. The horse probably whinnied as Kara approached because he _____.

a. was Kara's horse and recognized her
b. didn't like the men who were loading him
c. thought Kara seemed friendly
d. saw that Kara had some sugar for him

3. What happened first in the story?

a. The horse turned his head toward Kara.
b. Kara saw the familiar white blaze on the horse's nose
c. The horse kept rearing.
d. Kara stopped her bicycle at Clover's Stables.

4. Why were the men having a hard time loading the horse?

a. The horse kept turning toward Kara.
b. The trailer was too small.
c. Kara made the men nervous.
d. The horse kept kicking and rearing.

C. Read the story. Then answer the questions.

Antonio held his breath as he carefully placed another card on his card house. He picked up the next card very slowly so that he wouldn't knock his masterpiece down. He'd been working on it for days. Now the house covered on whole corner of the basement floor. Antonio cautiously leaned two more cards against the house. Then his dog Chester bounded down the basement stairs. "Chester! No!" Antonio hissed. "Go away!" Chester padded mournfully back upstairs. Antonio put the last card on the house and smiled triumphantly. "Wait until Mo, sees this!" he said as he ran upstairs.

5. What do you think Antonio did next?

a. He knocked down the card house.
b. He went out to play with Chester.
c. He brought his mother to see his card house.
d. He built a bigger card house.

6. Why did Antonio tell Chester to go away?

a. He was angry with Chester.
b. He was afraid Chester would knock down the card house
c. Chester was dirty.
d. Chester wasn't supposed to be in the basement.

7. What happened just before Chester bounded downstairs?

a. Antonio leaned two cards against the house.
b. Antonio called his mother.
c. Antonio went upstairs.
d. Antonio put the last card on the house.

8. Why did Antonio pick up one of the cards very slowly?

a. It was the last card.
b. He didn't want to knock down his masterpiece.
c. He was tired.
d. He was afraid Chester would grab it.

D. Read the story. Then answer the questions.

In 1985, the citizens of Boston, Massachusetts, began reporting a strange sight. They saw wild foxes, skunks, and raccoons living in their city. It was the oddest thing that had ever happened in Boston.

Strangest of all was that the raccoons and skunks seemed to like a city better than the forest! They ate garbage and often stayed in water pipes or basements. At the time of the reports, nobody was able to count the exact number of wild animals. This is because the animals hid carefully and came out mostly at night.

1. What is the main idea of the story?

a. Foxes, skunks, and raccoons were seen living in Boston in 1985.
b. Raccoons and skunks liked the city better than the forest.
c. The wild animals in Boston came out mostly at night.
d. The animals often lived in water pipes or basements.

2. What sentence is an opinion?

a. The raccoons and skunks ate garbage.
b. It was the oddest thing that had happened in Boston.
c. The animals hid carefully and came out at night.
d. Nobody was able to count the wild animals.

3. The author probably wrote this story to _____.

a. entertain with a funny story about animals.
b. describe the habits of raccoons and skunks.
c. persuade the reader that raccoons, skunks, and foxes are dangerous.
d. tell how some wild animals have moved to Boston.

4. Which is the best summary of the second paragraph?

a. The raccoons and skunks had become used to Boston and were hard to count.
b. Skunks and raccoons enjoy living in basements.
c. The citizens of Boston, Massachusetts, saw a very strange sight in 1985.
d. Wild animals must hide carefully to be safe.

D. Read the story. Then answer the questions.

Marty had a terrible time performing in the school play yesterday. During the first act, he forgot six lines. Then the curtain got stuck at the end of the second act. Marty didn't notice this, so he started to change his costume right in front of everybody.

During the third act, Marty was blinded be the spotlight and tripped over a chair. He fell into someone and knocked her down. Toward the end, he ripped his pants. Marty has a good sense of humor, though, and laughed along with everyone else.

5. What is the main idea of this story?

a. During the first act, Marty forgot six lines.
b. Marty had a terrible time in the school play yesterday.
c. Everybody laughed along with Marty.
d. Marty changed his costume in front of the audience.

6. Which sentence is an opinion?

a. Marty has a good sense of humor.
b. He fell into someone and knocked her down.
c. The curtain got stuck at the end of the second act.
d. Marty ripped his pants toward the end.

7. The author probably wrote this story to _____.

a. persuade the reader that Marty is a good actor.
b. describe all the actors in the school play.
c. tell what Marty's play was about.
d. entertain with a funny story about Marty.

8. Which is the best summary of the first paragraph?

a. Marty forgot six lines in the school play.
b. Marty tripped over a chair during the third act.
c. Marty made a lot of mistakes during the first two acts of the school play.
d. Marty thought the audience looked very funny, so he laughed at them.

E. Choose the synonym or antonym for the underlined word in each sentence.

1. Adria hauled on the boat's rope.

   A synonym for hauled is _____.

   a. sat
   b. pulled
   c. jumped
   d. stood

2. The people asked to have their freedom.

   A synonym for freedom is _____.

   a. money
   b. rights
   c. land
   d. liberty

3. Mr. Chang has a very harsh voice.

   A synonym for harsh is _____.

   a. rough
   b. soft
   c. clear
   d. pleasant

4. Megan tore Scott's notebook purposely.

   An antonym for purposely is _____.

   a. quickly
   b. accidentally
   c. excitedly
   d. angrily

5. The cat crept silently through the bushes.

   An antonym for silently is _____.

   a. swiftly
   b. softly
   c. curiously
   d. noisily

6. Ann's coat was surprisingly cheap.

   An antonym for cheap is _____.

   a. warm
   b. nice
   c. expensive
   d. handsome

F. Read each sentence. What is the meaning of the underlined word?

1. "I'll get that fly yet!" declared Camilla, brandishing a rolled-up magazine.

a. reading
b. tearing
c. waving
d. dropping

2. Tara was jubilant that she had won the canoe race.

a. sad
b. disappointed
c. angry
d. joyful

3. A film of dust covered the windows of the old house.

a. thin coating
b. strip of material used in photography
c. movie
d. mist

4. Mr. Ellis tried to drum the facts into his students' heads.

a. play a hollow instrument
b. teach by constantly repeating
c. tap with a steady beat
d. stir up interest

5. I like to row out onto the lake in the early morning.

a. move a boat using oars
b. a quarrel
c. things in a line
d. a line of seats

6. Patty has good conduct; she is always neat and polite.

a. act of guiding
b. lead a musical group
c. way a person behaves
d. allow electricity to pass through

G. Read the story. Then answer the questions.

Evan stood on the bridge above the brook. He looked at the sparkling water and sighed. A black cloud had hung over him all day. First he had bruised his knee. Then he had scolded his little sister unfairly. Later he had lost his new watch. "Why me?" he asked, but the only reply was the rushing sound of the water. Suddenly, the water spoke very clearly. "Things aren't so bad," it said. "Your knee will feel better tomorrow, and so will your sister once you apologize. And, by the way, your watch is under your bed."

1. How do your think Evan felt when he first stood on the bridge?

a. surprised
b. relieved
c. unhappy
d. nervous

2. Where does this story take place?

a. in Evan's room
b. at at lake
c. in a kitchen
d. by a brook

3. The water is different from real water because it _____.

a. makes a rushing sound
b. speaks clearly
c. has a bridge over it
d. sparkles

4. Which means the same as the underlined words in the story?

a. The weather had been rainy.
b. He had experienced bad fortune.
c. A swarm of mosquitoes had followed him around.
d. He had not been able to see clearly.

G. Read the story. Then answer the questions.

Jules woke up and peered at his alarm clock. "Oh no - late for school again!" he exclaimed, quickly strapping on his jet pack. He gobbled some toast for breakfast, then shot out of the space station. As he floated toward school, Jules shook his head. "I can't believe I almost slept through the morning when I give my history report," he said. He made it to school in the nick of time. "Are you ready?" his teacher asked. Jules cleared his throat and nodded. "Long ago, there was a strange and beautiful planet Earth," he began.

5. How so you think Jules felt when he woke up?

a. anxious
b. joyful
c. sad
d. proud

6. What is the plot of this story?

a. People from the planet Earth moved to a space station.
b. Jules slept late and almost missed giving his history report.
c. Students out in space learned to float.
d. Jules was careless and forgot to study for school.

7. In what way is Jules different from a boy on this planet?

a. He eats toast for breakfast.
b. He goes to school.
c. He lives in a space station.
d. He uses an alarm clock.

8. Which means the same as the underlined words in the story?

a. without checking the time
b. with plenty of extra time
c. by stopping the clocks
d. just barely in time

H. Use this section of a dictionary page to answer the questions below.

**em•blem** (em'bləm) *n.* an object or figure that identifies or represents something.

**em•brace** (em brās') *v.* 1. to take or hold in the arms as a sign of affection. 2. to surround: *Stone walls embrace the pasture.* 3. to accept eagerly: *Andrew embraced the opportunity to travel.* —*n.* 1. a friendly or loving hug.

**em•broi•der** (em broi'dər) *v.* 1. to decorate fabric with a needle and yarn. 2. to make more interesting by adding details.

**at; āpe; cär; end; mē; it; īce; hot; ōld; fôrk; půt; cūte; rūle; oil; out; up; tėrm; sing; thin; this; hw in white; zh in treasure. The symbol ə stands for the sound of a in about, e in taken, i in pencil, o in lemon, and u in circus.**

1. What does the word emblem mean?

a. to decorate fabric with a needle and yarn
b. a friendly or loving hug
c. to accept eagerly
d. an object that represents something

2. The first e in embroider sounds like the _____.

a. e in end
b. i in it
c. e in term
d. i in ice

3. Which meaning of embrace is used in the sentence below?

The mountains embrace the quiet green valley below.

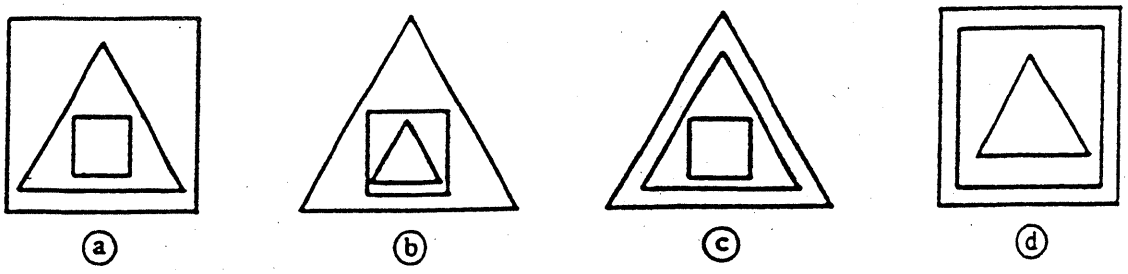
a. v. 1
b. v. 2
c. v. 3
d. n. 1

4. In another part of the dictionary, under which guide words would you look to find the word profile?

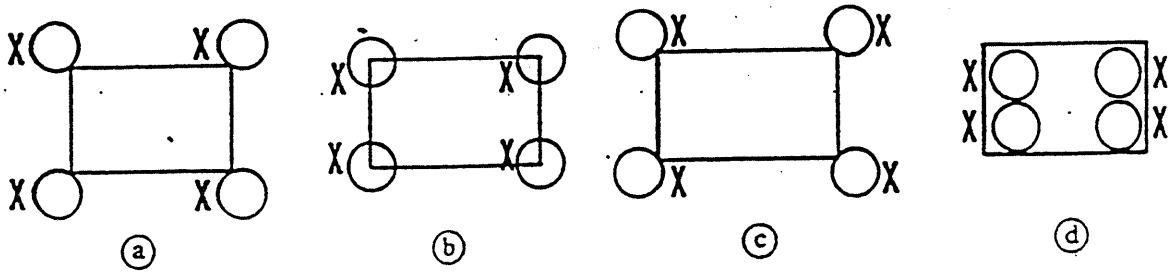
a. probable - probate
b. problem - proceed
c. product - progress
d. prohibit - proof

I. Read each set of directions. Choose the picture that shows the directions were followed correctly.

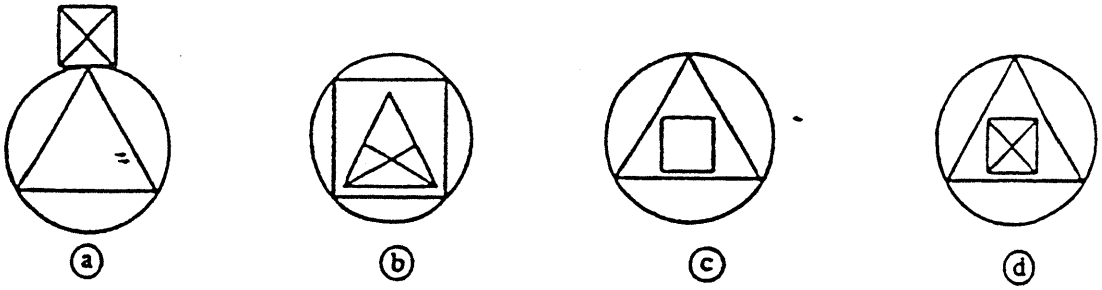
1. Draw a triangle. Draw a square around the triangle. Draw another triangle around the square.



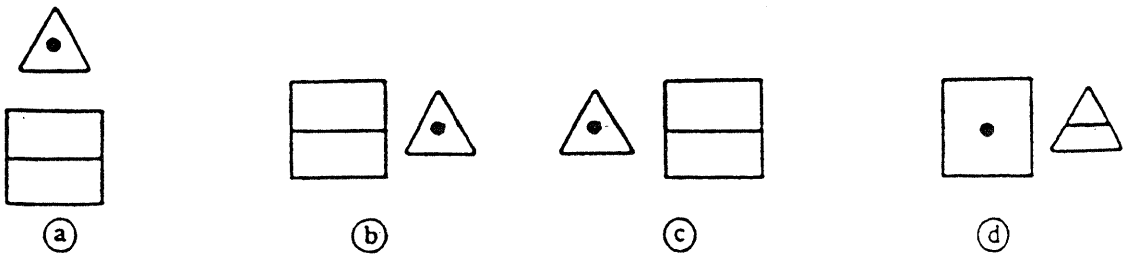

2. Draw a rectangle. Draw a circle outside each corner of the rectangle. Draw an "X" to the left of each circle.



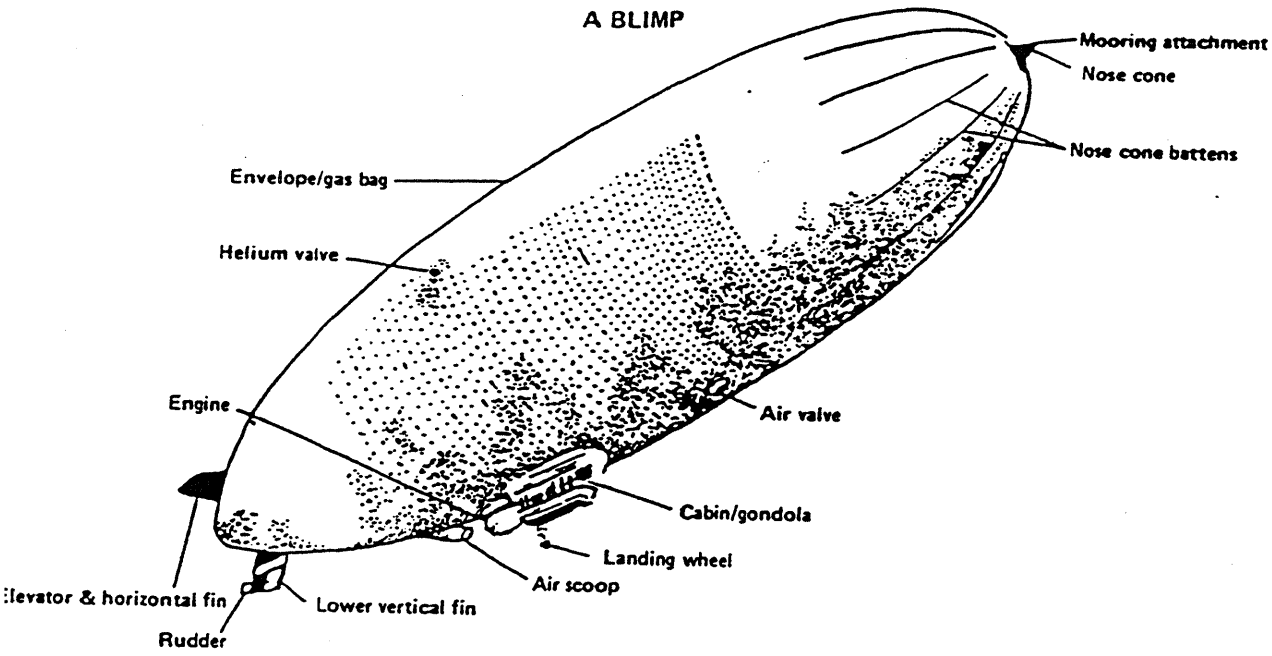

3. Draw a circle. Draw a triangle inside the circle. Draw a square inside the triangle. Draw an "X" inside the square.




4. Draw a square. Draw a line through the middle of the square. Draw a triangle to the right of the square. Draw a dot in the middle of the triangle.



J. Use the diagram to answer the questions below.




1. The part to which the rudder is attached is called the _____.

a. nose cone
b. lower vertical fin
c. engine
d. elevator

2. Where is the mooring attachment located?

a. above the air scoop
b. under the gondola
c. on the nose cone
d. next to the air valve

3. Another name for the cabin is the _____.

a. gondola
b. helium valve
c. gas bag
d. elevator

4. Where is the engine located?

a. next to the helium valve
b. behind the cabin
c. inside the air scoop
d. right above the horizontal fin

K. Use the table to answer the questions below.

Average Monthly Weather in Auckland, New Zealand

| | Average Temperatures | | | | Days of Rain or Snow |
|---|---|---|---|---|---|
| | F° | | C° | | |
| | High | Low | High | Low | |
| Jan. | 79° | 53° | 26° | 12° | 10 |
| Mar. | 77° | 51° | 25° | 11° | 11 |
| June | 63° | 39° | 17° | 4° | 19 |
| Aug. | 63° | 39° | 17° | 4° | 19 |
| Oct. | 68° | 44° | 20° | 7° | 16 |

1. Which month has the same average weather as June?

a. October
b. March
c. August
d. January

2. Which month has the fewest days of rain and snow?

a. August
b. January
c. March
d. October

3. What is the average low temperature in F degrees in March?

a. 11 degrees
b. 25 degrees
c. 51 degrees
d. 77 degrees

4. In which month is the average high temperature 20 degrees C?

a. June
b. October
c. January
d. March

APPENDIX B

Description of the Test

| art | # of questions | Objectives | Specific Skills |
|---|---|---|---|
| . | 8 | Decoding & Phonics | suffixes<br>prefixes |
| . | 4 | Decoding & Phonics | base words |
| . | 8 | Comprehension & Vocabulary | inference<br>sequence<br>comprehension<br>predict outcomes<br>cause/effect |
| ). | 8 | Comprehension & Vocabulary | main idea<br>fact/opinion<br>author's purpose<br>summary |
| :. | 6 | Comprehension & Vocabulary | synonym/<br>antonym |
| :. | 6 | Comprehension & Vocabulary | context clues |
| ;. | 8 | Literature & Language | inferences |
| H. | 4 | Study Skills | word meaning<br>dictionary use |
| . | 4 | Study Skills | multistep<br>directions |

| | | | |
|---|---|---|---|
| J. | 4 | Study Skills | diagrams |
| K. | 4 | Study Skills | interpret graphic aids |
| | 66 | Total Testing Items | |

# APPENDIX C

## Procedures for Administering the Test

A critical requirement in criterion-referenced testing is that students understand exactly what they are expected to do. In order to administer the test efficiently and make directions understandable, the teacher should become familiar with the directions and the test items before the test is given. In addition, the teacher should closely monitor the students' test taking behavior to make sure that each child is following the directions, is on the correct item, and is marking the test form correctly.

Lighting, ventilation, and space should contribute to the comfort of the setting in which the test is administered. Effort should also be made to minimize distractions such as noise or activities that draw the students' attention from the test.

The items on this test are not timed. This test should be administered in more than one sitting depending upon the needs of the students. Two sessions of forty minutes should give all students ample time for the completion of this test. An additional ten minutes should be scheduled for each testing session to allow time for distributing and collecting material.

# APPENDIX D

## Raw Score

| ID# | District | Gender | TTL RSA | TTL RSB |
|---|---|---|---|---|
| 1 | 0 | 1 | 54 | 59 |
| 2 | 0 | 0 | 54 | 53 |
| 3 | 0 | 1 | 52 | 56 |
| 4 | 0 | 1 | 49 | 52 |
| 5 | 0 | 0 | 50 | 51 |
| 6 | 0 | 0 | 51 | 53 |
| 7 | 0 | 0 | 40 | 42 |
| 8 | 0 | 0 | 48 | 56 |
| 9 | 0 | 0 | 59 | 61 |
| 10 | 0 | 1 | 58 | 61 |
| 11 | 0 | 1 | 51 | 53 |
| 12 | 0 | 0 | 54 | 58 |
| 13 | 0 | 1 | 51 | 49 |
| 14 | 0 | 0 | 47 | 44 |
| 15 | 0 | 1 | 57 | 62 |
| 16 | 0 | 1 | 60 | 66 |
| 17 | 0 | 0 | 43 | 45 |
| 18 | 0 | 0 | 58 | 53 |
| 19 | 0 | 1 | 62 | 63 |
| 20 | 0 | 1 | 42 | 54 |
| 21 | 0 | 0 | 18 | 26 |
| 22 | 0 | 1 | 62 | 62 |
| 23 | 0 | 0 | 58 | 59 |
| 24 | 0 | 0 | 39 | 42 |
| 25 | 0 | 0 | 35 | 48 |
| 26 | 0 | 0 | 59 | 59 |
| 27 | 0 | 1 | 42 | 58 |
| 28 | 0 | 0 | 39 | 56 |
| 29 | 0 | 0 | 52 | 62 |
| 30 | 0 | 0 | 43 | 47 |
| 31 | 1 | 0 | 52 | 56 |
| 32 | 1 | 1 | 40 | 45 |
| 33 | 1 | 1 | 54 | 58 |
| 34 | 1 | 1 | 50 | 51 |
| 35 | 1 | 1 | 44 | 56 |
| 36 | 1 | 0 | 40 | 46 |
| 37 | 1 | 0 | 40 | 46 |
| 38 | 1 | 1 | 55 | 58 |

| ID# | District | Gender | TTL RSA | TTL RSB |
|---|---|---|---|---|
| 39 | 1 | 0 | 47 | 57 |
| 40 | 1 | 1 | 57 | 62 |
| 41 | 1 | 0 | 58 | 60 |
| 42 | 1 | 0 | 58 | 61 |
| 43 | 1 | 1 | 58 | 59 |
| 44 | 1 | 0 | 58 | 57 |
| 45 | 1 | 1 | 59 | 57 |
| 46 | 1 | 0 | 61 | 60 |
| 47 | 1 | 1 | 40 | 47 |
| 48 | 1 | 1 | 54 | 55 |
| 49 | 1 | 0 | 40 | 40 |
| 50 | 1 | 1 | 29 | 35 |
| 51 | 1 | 1 | 34 | 39 |
| 52 | 1 | 1 | 61 | 63 |
| 53 | 1 | 0 | 38 | 35 |
| 54 | 1 | 0 | 51 | 57 |
| 55 | 1 | 1 | 39 | 37 |
| 56 | 1 | 0 | 50 | 56 |
| 57 | 1 | 1 | 51 | 56 |
| 58 | 1 | 1 | 56 | 55 |

Variable Labels:

| | |
|---|---|
| ID | Student Identification Number |
| District | School District |
| Gender | Student Gender |
| TTL RSA | Total Raw Score Test A |
| TTL RSB | Total Raw Score Test B |
| District | 0 - Harmony; 1 - Mabel-Canton |